

1 CLAIMS:

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3 1. A semiconductor processing method of forming integrated
4 circuitry comprising:

5 forming memory circuitry and peripheral circuitry over a substrate,
6 the peripheral circuitry comprising first and second type MOS transistors;
7 and

8 conducting second type halo implants into the first type MOS
9 transistors in less than all peripheral MOS transistors of the first type.
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11 2. The semiconductor processing method of claim 1, wherein the
12 second type is p-type.
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14 3. The semiconductor processing method of claim 1, wherein the
15 conducting of the second type halo implants comprises conducting said
16 implants into only one of the source and drain regions in the less than
17 all of the peripheral MOS transistors of the first type, and not the
18 other of said source and drain regions of said less than all of the
19 peripheral MOS transistors of the first type.
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1 4. The semiconductor processing method of claim 1, wherein:
2 the second type is p-type; and
3 the conducting of the second type halo implants comprises
4 conducting said implants into only one of the source and drain regions
5 in the less than all of the peripheral MOS transistors of the first type,
6 and not the other of said source and drain regions of said less than all
7 of the peripheral MOS transistors of the first type.

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9 5. In a common masking step and in a common implant step,
10 conducting a halo implant of devices formed over a substrate comprising
11 memory circuitry and peripheral circuitry sufficient to impart to at least
12 three of the devices three different respective threshold voltages.

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14 6. The method of claim 5, wherein said three devices comprise
15 peripheral circuitry.

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17 7. The method of claim 5, wherein said three devices comprise
18 NMOS field effect transistors.

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20 8. The method of claim 5, wherein said three devices comprise
21 NMOS field effect transistors comprising peripheral circuitry.
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1 9. The method of claim 5, wherein said three devices comprise
2 PMOS field effect transistors.

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4 10. The method of claim 5, wherein said three devices comprise
5 PMOS field effect transistors comprising peripheral circuitry.

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7 11. The method of claim 5, wherein the common masking step
8 comprises masking only portions of some of the devices which receive
9 the halo implant, said portions comprising portions of peripheral circuitry
10 devices.

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12 12. The method of claim 5, wherein:
13 the common masking step comprises masking only portions of some
14 of the devices which receive the halo implant;
15 said devices which receive the halo implant comprise NMOS field
16 effect transistors; and
17 said portions comprise portions of peripheral circuitry devices.

1 13. The method of claim 5, wherein:
2 the common masking step comprises masking only portions of some
3 of the devices which receive the halo implant;
4 said devices which receive the halo implant comprise NMOS field
5 effect transistors having source regions and drain regions; and
6 said portions comprise portions of peripheral circuitry devices,
7 wherein said masking comprises masking only one of the source region
8 and drain region for one of the three devices, and exposing both of the
9 source region and drain region for another of the three devices.

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11 14. The method of claim 5, wherein:
12 the common masking step comprises masking only portions of some
13 of the devices which receive the halo implant;
14 said devices which receive the halo implant comprise PMOS field
15 effect transistors; and
16 said portions comprise portions of peripheral circuitry devices.

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1 15. The method of claim 5, wherein:
2 the common masking step comprises masking only portions of some
3 of the devices which receive the halo implant;
4 said devices which receive the halo implant comprise PMOS field
5 effect transistors having source regions and drain regions; and
6 said portions comprise portions of peripheral circuitry devices,
7 wherein said masking comprises masking only one of the source region
8 and drain region for one of the three devices, and exposing both of the
9 source region and drain region for another of the three devices.

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11 16. In a common masking step and in a common implant step,
12 conducting a halo implant of devices formed over a substrate comprising
13 memory circuitry and peripheral circuitry sufficient to impart to at least
14 three of the devices three different respective threshold voltages, at least
15 some of the devices forming memory access devices.

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18 17. The method of claim 16, wherein the at least some of the
19 devices forming memory access devices receive halo implants on a bitline
20 contact side of the devices.

1 18. A semiconductor processing method of forming integrated
2 circuitry comprising:

3 forming a plurality of n-type transistor devices over a substrate,
4 said n-type devices comprising memory array circuitry and peripheral
5 circuitry, individual n-type transistor devices having source regions and
6 drain regions;

7 partially masking at least some individual memory array devices
8 and peripheral circuitry n-type transistor devices; and

9 with said at least some of the memory array and peripheral
10 circuitry n-type transistor devices being partially masked, conducting a
11 halo implant for unmasked portions of said at least some peripheral
12 circuitry n-type transistor devices.

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14 19. The semiconductor processing method of claim 18, wherein
15 the masking comprises masking storage node portions of one of the
16 source region and drain region and not bitline contact portions of the
17 other of the source region and drain region for said at least some
18 individual memory array circuitry n-type transistor devices.

1 20. The semiconductor processing method of claim 18, wherein
2 the masking comprises masking majority portions of one of the source
3 region and drain region and not majority portions of the other of the
4 source region and drain region for said at least some individual
5 peripheral circuitry n-type transistor devices.
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7 21. The semiconductor processing method of claim 18, wherein
8 the masking comprises masking one of the source region and drain
9 region and not the other of the source region and drain region for said
10 at least some individual peripheral circuitry n-type transistor devices.
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12 22. The semiconductor processing method of claim 18, wherein
13 the masking comprises masking the source regions of said at least some
14 individual peripheral circuitry n-type transistor devices.
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16 23. The semiconductor processing method of claim 18, wherein
17 the masking comprises masking the drain regions of said at least some
18 individual peripheral circuitry n-type transistor devices.
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24. The semiconductor processing method of claim 18, wherein the masking comprises (a) masking portions of only one of the source region and drain region for some of the at least some individual peripheral circuitry n-type transistor devices, and also (b) masking both source regions and drain regions for other individual peripheral circuitry n-type transistor devices.

25. The semiconductor processing method of claim 24, wherein said masking of the portions of only one of the source region and drain region comprises masking an entirety of said portions of only one of the source region and drain region for said at least some individual peripheral circuitry n-type transistor devices.

26. The semiconductor processing method of claim 18, wherein the masking comprises (a) masking portions of only one of the source region and drain region for some of the at least some individual peripheral circuitry n-type transistor devices, and also (b) leaving source regions and drain regions exposed for other individual peripheral circuitry n-type transistor devices.

1 27. The semiconductor processing method of claim 18, wherein
2 the masking comprises (a) masking portions of only one of the source
3 region and drain region for some of the at least some individual
4 peripheral circuitry n-type transistor devices, and also (b) masking both
5 source regions and drain regions for other individual peripheral circuitry
6 n-type transistor devices, and (c) leaving source regions and drain regions
7 exposed for different other individual peripheral circuitry n-type transistor
8 devices.

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10 28. A semiconductor processing method of forming integrated
11 circuitry comprising:

12 forming a plurality of n-type transistor devices over a substrate
13 comprising memory array circuitry and peripheral circuitry, individual n-
14 type transistor devices having source regions and drain regions;

15 masking at least a portion of one of the source and drain regions
16 for at least some of the peripheral circuitry n-type transistor devices, and
17 exposing at least a portion of the other of the source and drain regions
18 for said at least some peripheral circuitry n-type transistor devices; and

19 conducting a halo implant of the exposed portions of the other of
20 the source and drain regions.
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1 29. The semiconductor processing method of claim 28, wherein
2 the masking comprises masking the entire portion of the one source and
3 drain region for said at least some of the peripheral circuitry n-type
4 transistor devices.
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6 30. The semiconductor processing method of claim 28, wherein
7 the masking comprises exposing the entire portion of the other of said
8 source and drain regions for said at least some peripheral circuitry n-
9 type transistor devices.
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11 31. The semiconductor processing method of claim 28, wherein
12 the masking comprises:

13 masking the entire portion of the one source and drain region for
14 said at least some of the peripheral circuitry n-type transistor devices;
15 and

16 exposing the entire portion of the other of said source and drain
17 regions for said at least some peripheral circuitry n-type transistor
18 devices.
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20 32. The semiconductor processing method of claim 28, wherein
21 the masking comprises also masking both source regions and drain
22 regions for other peripheral circuitry n-type transistor devices.
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1 33. The semiconductor processing method of claim 28, wherein
2 the masking comprises leaving both source regions and drain regions for
3 other peripheral circuitry n-type transistor devices exposed.

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5 34. The semiconductor processing method of claim 28, wherein
6 the masking comprises:

7 also masking both source regions and drain regions for other
8 peripheral circuitry n-type transistor devices; and

9 leaving both source regions and drain regions for different other
10 peripheral circuitry n-type transistor devices exposed.

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12 35. The semiconductor processing method of claim 28, wherein
13 the masking comprises:

14 masking the entire portion of the one source and drain region for
15 said at least some of the peripheral circuitry n-type transistor devices;

16 also masking both source regions and drain regions for other
17 peripheral circuitry n-type transistor devices; and

18 leaving both source regions and drain regions for different other
19 peripheral circuitry n-type transistor devices exposed.
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1 36. The semiconductor processing method of claim 28, wherein
2 the masking comprises:

3 masking the entire portion of the one source and drain region for
4 said at least some of the peripheral circuitry n-type transistor devices;

5 exposing the entire portion of the other of said source and drain
6 regions for said at least some peripheral circuitry n-type transistor
7 devices;

8 also masking both source regions and drain regions for other
9 peripheral circuitry n-type transistor devices; and

10 leaving both source regions and drain regions for different other
11 peripheral circuitry n-type transistor devices exposed.
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1 37. A semiconductor processing method of forming integrated
2 circuitry comprising:

3 forming a plurality of NMOS field effect transistor devices over a
4 substrate comprising memory array circuitry and peripheral circuitry,
5 individual NMOS transistor devices having source regions and drain
6 regions;

7 forming a mask over the substrate, the mask (a) exposing source
8 and drain regions of first NMOS transistor devices, (b) covering source
9 and drain regions of second NMOS transistor devices, and (c) partially
10 exposing only a portion of third NMOS transistor devices; and

11 with the mask in place, conducting a halo implant.

12
13 38. The semiconductor processing method of claim 37, wherein
14 the forming of the mask to partially expose only a portion of the third
15 NMOS transistor devices comprises exposing an entirety of one of the
16 source and drain regions and not an entirety of the other of the source
17 and drain regions for the third NMOS transistor devices.

1 39. The semiconductor processing method of claim 37, wherein
2 the forming of the mask to partially expose only a portion of the third
3 NMOS transistor devices comprises exposing one of the source and drain
4 regions and not the other of the source and drain regions for the third
5 NMOS transistor devices.

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7 40. The semiconductor processing method of claim 37, wherein
8 the forming of the mask to partially expose only a portion of the third
9 NMOS transistor devices comprises exposing a portion of one of the
10 source and drain regions and not the other of the source and drain
11 regions for the third NMOS transistor devices.

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13 41. A method of improving DRAM storage cell retention time
14 comprising conducting, in a common masking step and in a common
15 implant step, a halo implant of devices formed over a substrate
16 comprising memory circuitry and peripheral circuitry sufficient to impart
17 to each device one of two or more different respective threshold
18 voltages, at least some of the devices forming memory access devices,
19 wherein the at least some of the devices forming memory access devices
20 receive halo implants on a bit line contact side of the devices.

1 42. The method of claim 41 wherein the halo implant is
2 performed prior to formation of sidewall spacers in the memory access
3 devices.

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5 43. The method of claim 41 wherein the halo implant is
6 performed after formation of sidewall spacers in the memory access
7 devices.

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9 44. The method of claim 41 wherein the halo implant is
10 accompanied with an n-minus implant on the bit line contact side.

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12 45. The method of claim 41 wherein the storage node side of
13 the memory access device is masked from the halo implant.

14
15 46. A method of improving DRAM storage cell retention time
16 comprising forming memory access devices having different implants and
17 hence different junction structures on a bitline contact side and a
18 storage node side respectively.

1 47. The method of claim 46 wherein forming memory access
2 devices includes:

3 performing, during a masking and implant step, a one-sided halo
4 implant on the bitline contact side; and

5 performing, during the masking and implant step, an n-minus
6 implant on the bitline contact side.

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8 48. The method of claim 47, wherein performing a one-sided
9 halo implant is performed prior to formation of sidewall spacers.

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11 49. The method of claim 46, wherein the storage node side is
12 masked during a one-sided halo implant on the bitline contact side.